

Two Studies on Impacts of Highway Culverts on Salmon and Steelhead:

1. F 2001 EN 10 Researching State Highway Culverts to Determine Impacts on Threatened and Endangered Salmon
2. SPR 0003(096) Fish Passage Capability Through Modified Culverts – Flume Research Study

Why We Are Pursuing This Research



Fall Run Chinook Salmon
(CA Department of Fish and Game)

Salmon and steelhead are important resources for the people of California. Many salmon and steelhead populations are listed as threatened or endangered, requiring protection under the Endangered Species Act. Nearly all of these fish must pass under roads of the state highway system to find the habitats they need for survival and successful reproduction.

Salmon and steelhead passage through culverts is a major issue throughout much of California. Improperly designed culverts at road crossings can prevent fish from reaching necessary habitats and cause declines in sensitive populations. Impassible culverts may sever populations, reducing the genetic diversity both upstream and downstream of the culvert. Blockages may prevent juvenile fish from reaching food, reducing the carrying capacity of a stream. Additionally, juvenile fish may be prevented from reaching cool water summer refugia and slack water winter refugia, also reducing the carrying capacity of a stream. Fires, floods, and other disasters may extirpate fish populations upstream of a blockage and migrants will not be able to reoccupy the habitat as conditions improve.

Culverts need to effectively move water downstream under a road, protecting the road. They also need to allow both adult and juvenile fish to freely pass both upstream and downstream.

We are sponsoring two research projects to help meet Caltrans' needs in this area. One project is to identify State highway culverts that block passage of salmon and steelhead and develop a prioritized list of state highway culverts needing to be replaced or repaired to facilitate fish passage. This project is part of a much larger effort to improve fish passage throughout California.

The other project is to use a specially fabricated testbed to identify the culvert designs and associated hydraulic conditions that allow successful upstream movement of juvenile salmon and steelhead. This is a pooled-fund project that includes departments of transportation from Alaska, Oregon, Washington, and California, along with the Washington Department of Fish and Wildlife, the Federal Highway Administration and the Pacific Northwest National Laboratory.



Impassible Highway Culvert in Humboldt County

What We Are Doing

The Culvert Survey Project is now surveying State highway culverts in northwestern California. Dr. Margaret Lang of Humboldt State University is principal investigator of this effort. The Humboldt State team is using a three-tiered protocol to progressively determine the ability of fish to traverse culverts. The first pass protocol determines if a culvert clearly passes or prohibits fish passage. The second pass protocol is used to determine the passability of culverts that cannot be categorized by the first pass. The third pass protocol gathers detailed hydraulic information on the culvert. Culverts are ranked as Red (those with extreme fish passage problems), Gray (those

that are only partially passable) and Green (those that should pass all species and life stages). The results are being compiled in a database.

At this point all but one north coast State route has been surveyed with the first pass protocol. Four routes have all surveys and hydraulic analyses completed. 82% of the routes have some or all of the second pass surveys completed.



Skookumchuck Culvert Testbed

A culvert testbed has been constructed in at the fish hatchery in Skookumchuck, Washington. The testbed allows studies on variations in slope, flow, culvert type and size, culvert bottom configurations and materials, and passage cues for juvenile coho salmon and steelhead. The testbed is designed to rapidly provide scientifically sound, statistically derived information that can be used in retrofitting existing culverts and developing better culvert designs while reducing the number of expensive field trials. The Pacific Northwest National Laboratory is conducting the work.

What We Have Concluded So Far

In the culvert survey project a number of problem culverts have been identified. A list of potential rehabilitation sites is under development.



In the culvert testbed project, the testbed has been constructed and instrumented. Initial runs of juvenile coho establish that the fish will attempt to traverse the corrugated culvert currently in place. A testing protocol for various flows and cues has been developed and testing has begun. Juvenile coho with a mean forklength of 139 mm had greater absolute passage success in the corrugated culvert than juvenile coho with a mean forklength of 55 mm. Some workers had hypothesized that smaller fish would be able to use the slack water areas between the corrugations as resting places. Upstream volitional movement for juvenile coho in the test culvert appears to be stronger during the night than during the day. This agrees with field observations by U. S. Forest Service workers that juvenile coho move mainly at night.

Implementation Strategies

The Division of Environmental Analysis and the Districts are already using the information database being developed in the culvert survey project. An instance is the culvert rehabilitation project for Mendocino 128/253. The Environmental Division has also expanded this effort to include additional parts of the state, and to join the efforts of the Department of Water Resources, the Department of Fish and Game, and the Northern California Tribes.

The knowledge generated from the test bed project will be used to design culverts and guide culvert installation.

For more information on about these research projects contact:

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